

Bark Beetles
of British Columbia



**Province of
British Columbia**

**Ministry
of Forests**

BARK BEETLES

Bark beetles pose a serious threat to the health of mature coniferous forests in British Columbia. Each year, they attack thousands of hectares of trees. To date, bark beetles are responsible for the destruction of more timber than any other damaging agents.

Adult bark beetles bore under the bark of trees and lay their eggs along galleries in the phloem. When the larvae hatch from these eggs, they feed on the phloem and cambium tissue. Boring adults also introduce a blue-stain fungus which colonizes and kills sapwood cells. The tree dies as a result of being girdled by a combination of fungus-killed cells and feeding larvae. Outbreaks initially occur in over-mature stands of coniferous trees, or in mature stands that are stressed by drought, defoliation, root diseases, or other damaging agents. Most bark beetles, however, are capable of attacking healthy trees whenever population numbers are sufficient to overcome a tree's resistance and if appropriate environmental conditions prevail. Severe outbreaks of some species of bark beetles also occur as a result of beetle populations building up in logging slash and windfalls on the edges of untended stands.

The life cycles of the various bark beetle species follow a similar pattern. The beetles overwinter under the bark of infested trees as young or mature adults, or larvae in various stages of development (only rarely do they overwinter as eggs). In the spring, mature adults either continue to burrow along old galleries or emerge to start new ones. The young adults complete their maturation and leave their original host to find another. The mature larvae pupate while younger larvae complete their development and then pupate. Any overwintering eggs hatch and begin the first stages of larval development. As a result of this overlapping development, adult beetles emerge and attack new trees throughout the spring, summer, and fall months. The length of the life cycle depends upon the species, geographical location, and the prevailing weather conditions.

The adult of each species can be distinguished from others by coloring, size, and body features. The eggs, larvae, and pupae, however, exhibit few differences between species. Eggs are usually pearly white, ovoid, and 0.5 mm to 1.0 mm long. Larvae are white, legless, stout-bodied grubs with pale, brown heads and range from 1.0 mm to 7.0 mm depending on their instar level. Pupae are pale white to light tan and they tend to show signs of adult features.

Damage symptoms vary by species, but attacked trees generally exhibit discolored foliage, boring dust, woodpecker damage, and pitch tubes. Long-term control options involve the use of prescribed silvicultural procedures while short-term direct control methods include sanitation logging, single tree treatments, and trap trees. Photographs and descriptions of important bark beetles follow.

PHOTOGRAPHIC ACKNOWLEDGEMENTS

The photographs in this publication were reproduced with kind permission from the following sources.

Forest Insect and Disease Survey, Canadian Forestry Service, Pacific Forestry Research Centre: Figures 1-12, 15, 16, 18, 19, 23-26, and 29.

Pacific Forestry Research Centre, Canadian Forestry Service: Figures 27, 28, and 30.

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BARK BEETLES**MOUNTAIN PINE BEETLE** *Dendroctonus ponderosae*

DISTRIBUTION: Throughout the range of its principal host.

TREE SPECIES ATTACKED: Large diameter, mature and over-mature lodgepole pine are by far the most commonly affected tree species. Western white and ponderosa pine may also be attacked.

INSECT DESCRIPTION AND DAMAGE SYMPTOMS: Generally, mountain pine beetles have a one-year life cycle. Two-year cycles are common at high elevations and in northern latitudes. The adults are hard, stout-bodied, cylindrical insects, ranging in length from 3.5 to 6.5 mm. They have black heads and thorax, and black or brownish bodies. Adults construct vertical egg galleries in the phloem and cambium tissues. The galleries may be nearly straight or somewhat sinuous, and at the bottom there is a short crook or bend. The galleries nearly always follow the grain of the wood and are packed with frass. Overwintering larvae resume feeding in April and complete development in June. Pupae transform into adults during mid-summer and emerge in mid to late July.

Damage symptoms include reddish boring dust at the base of attacked trees and bark removal by woodpeckers. Trees will attempt to repel the beetles by releasing quantities of resin which mixes with the boring dust and forms a soft white or reddish pitch tube around each bore hole. Tree foliage turns yellow and then red by the spring of the year following the initial beetle attack. Most of the needles drop from the tree after two years, leaving a dead gray snag.

DAMAGE: Mountain pine beetles primarily attack living, older, large-diameter trees. Outbreaks initially occur in less healthy, over-mature stands, but, as more trees become infested, the beetle population increases and spreads to healthy and progressively smaller trees. As a result, huge areas of pine may be killed. Trees are killed when the flow of food and water between the roots and needles is blocked by a combination of feeding larvae and dead sapwood cells killed by the blue-stain fungus carried by the mountain pine beetle adults.

REFERENCES: Furniss, R.L. and V.M. Carolin. 1980. Western forest insects. 1977. U.S.D.A. Forest Service. Misc. Pub. 1339. 654p.

Unger, L. Mountain pine beetle. 1993. Canadian Forestry Service, Pacific Forestry Centre. Forest Pest Leaflet 76. 8p.

Young, C. 1988. Coming of age in the flathead. B.C. Ministry of Forests. Pest Management Report no. 10. 31p.

SPRUCE BEETLE *Dendroctonus rufipennis* (Kirby)

DISTRIBUTION: Throughout the range of spruce.

TREE SPECIES ATTACKED: Engelmann, white, Sitka and, rarely, black spruce.

INSECT DESCRIPTION AND DAMAGE SYMPTOMS: The spruce beetle usually has a two-year life cycle although a one-year cycle can occur in some areas. Where this occurs, it can result in the "doubling" of beetle flight numbers. Spruce beetle larvae can be distinguished from other *Dendroctonus* species by the presence of two anal shields. Adults are hard, stout-bodied, cylindrical insects, ranging in length from 4.0 to 7.0 mm. They are black/brown or black with reddish wing covers. Adults emerge and attack fresh host material from late May to early July, and they emerge again in the fall to overwinter at the base of the tree.

Adults construct long galleries in the phloem. Light-brown, coarse boring dust will be present on infested trees. Pitch tubes are occasionally formed by resin flowing out of the entrance holes made by attacking beetles. Sometimes flaking of the bark by woodpeckers is a sign of infestation. Fading of the foliage to a yellowish green may be noticeable during the winter following the attack, particularly in the lower crown. By the second autumn, most of the needles may have been lost and, for a year or two, the tree will have a brown appearance from a distance. Green needles on the ground or on the leaves of ground cover beneath infested trees may appear before any evidence is visible in the crown itself.

DAMAGE: Spruce beetles normally infest downed trees or logging debris, but, when beetle populations are large, they will attack and kill living trees causing widespread damage. Trees are killed when the flow of food and water between the roots and needles is blocked by a combination of feeding larvae and dead sapwood cells killed by the blue-stain fungus carried by the spruce beetle adults.

REFERENCES: Cottrell, C.B. 1978. Spruce beetle in British Columbia. Canadian Forestry Service, Pacific Forestry Centre. Forest Pest Leaflet 13. 4p.

Furniss, R.L. and V.M. Carolin. 1980. Western forest insects. 1977. U.S.D.A. Forest Service. Misc. Pub. 1339. 654p.

BARK BEETLES

DOUGLAS-FIR BEETLE *Dendroctonus pseudotsugae*

DISTRIBUTION: Throughout most of the range of its principal host. Damage is usually most intensive in the interior of British Columbia.

TREE SPECIES ATTACKED: Douglas-fir and occasionally downed western larch.

INSECT DESCRIPTION AND DAMAGE SYMPTOMS: Adults are dark brown to black with reddish wing covers and about 4.4 to 7.0 mm long. The usual life cycle is one year, but two broods may be produced. The main flight period usually occurs in May and June, while a second flight in July and August may be made by adults developed from overwintering larvae or adults re-emerging after the earlier flight.

Adults lay their eggs in long galleries which are constructed parallel to the grain of the inner bark. Reddish or yellowish boring dust may be found in bark crevices or at the base of the tree. Pitch tubes are not formed, but the tree may exude resin from upper attacks. Foliage of killed trees turns from green to pale yellow-green to red by the spring of the year following the attack. Red needles may remain on the tree for up to two years after an attack and aerial spotting of these "redtops" helps to determine the extent of an outbreak. Sometimes needles will drop without any discoloration.

DAMAGE: Douglas-fir beetles normally infest felled trees, over-mature and damaged trees, logging debris, and trees stressed by drought. When sufficient host material is unavailable, however, they will attack and kill vigorous trees causing more extensive damage. Trees are killed when the flow of food and water between the roots and needles is blocked by feeding larvae and by dead sapwood cells killed by the blue-stain fungus carried by the Douglas-fir beetle adults.

REFERENCES: Furniss, R.L. and V.M. Carolin. 1980. Western forest insects. 1977. U.S.D.A. Forest Service. Misc. Pub. 1339. 654p.

McMullen, L.H. 1984. Douglas-fir beetle in British Columbia. Canadian Forestry Service, Pacific Forestry Centre. Forest Pest Leaflet 14. 6p.

BARK BEETLES

IPS BEETLE *Ips* spp.

DISTRIBUTION: Throughout province wherever host species exists.

TREE SPECIES ATTACKED: The most critical attacks occur in white and Engelmann spruce, and lodgepole and ponderosa pine.

INSECT DESCRIPTION AND DAMAGE SYMPTOMS: Adults are reddish-brown to black, often shiny, cylindrical, and about 3.0 to 6.5 mm long. An easily recognizable feature of the adult is a pronounced concave depression at its rear end which is lined on each side with up to five toothlike spines. The head is not visible when viewed from above.

Adults emerge and attack from mid-May to early June. Pitch tubes are rarely formed, but yellow-red boring dust is usually found in bark crevices. A change in the foliage color from dark to faded green is usually the first symptom recognized, but the best way to determine if a tree has been attacked by Ips is to remove a piece of bark and examine the tree for evidence of egg galleries. Ips egg gallery patterns consist of a central nuptial chamber from which two or more egg galleries radiate. Larval galleries extend at right angles to the egg galleries and often score the surface of the sapwood, a characteristic which causes some to call the Ips "engraver beetles." The galleries are free of boring dust and frass.

DAMAGE: Ips usually only attack dead, dying or damaged trees. They are also often found in the upper portions and on the south sides of mountain pine beetle attacked trees. However, heavy populations can build up in windthrow and slash which can pose a threat to healthy, green trees. Ips damage often occurs at margins of cut blocks.

REFERENCES: Furniss, R.L. and V.M. Carolin. 1980. Western forest insects. 1977. U.S.D.A. Forest Service. Misc. Pub. 1339. 654p.

Holsten, E.H., R.A. Werner, and T.H. Laurent. 1980. Insects and diseases of Alaskan forests. U.S.D.A. Forest Service. Alaska Region Report Number 75. 187p.

LODGEPOLE PINE BEETLE *Dendroctonus murryanae*

DISTRIBUTION: Throughout the range of its principal host.

TREE SPECIES ATTACKED: Lodgepole pine.

INSECT DESCRIPTION AND DAMAGE SYMPTOMS: The adult is a 5.5 to 6.5 mm long dark brown to black beetle with reddish-brown wing covers. The larvae can be distinguished from other *Dendroctonus* species by the presence of two anal shields. One generation appears to be completed each year.

Lodgepole pine beetles usually only attack over-mature, injured or weakened trees, fresh stumps, and windfalls. Occasionally, they will attack more vigorous trees and these attacks are marked by the presence of large pitch tubes and resinous boring dust on the lower bole and root crown. The adults construct short, stout egg galleries. Larval galleries run off from the sides, but they usually run together and become indistinct.

DAMAGE: This beetle is not an aggressive tree killer like the mountain pine beetle as it tends to mine only in the lower bole and root crown of stressed trees. Occasionally, it will attack and kill over-mature lodgepole pine left standing after timber harvesting. Fortunately, this activity usually only involves a few pairs of beetles and two or more generations may be required to actually kill a tree.

REFERENCES: Chamberlin, W.J. 1958. The Scolytoidea of the northwest. Oregon State College. Studies in Entomology, Number 2. 208p.

Furniss, R.L. and V.M. Carolin. 1980. Western forest insects. 1977. U.S.D.A. Forest Service. Misc. Pub. 1339. 654p.

WESTERN PINE BEETLE *Dendroctonus brevicornis*

DISTRIBUTION: Throughout the range of ponderosa pine west of the Rocky Mountains.

TREE SPECIES ATTACKED: Ponderosa pine.

INSECT DESCRIPTION AND DAMAGE SYMPTOMS: One to two generations of beetles are produced every year, depending upon the elevation. Adults are brown to black, cylindrical, stout, hardshelled, and about 3.0 to 5.0 mm long. They construct long, meandering, dust-packed galleries in the cambium of attacked trees. During periods of heavy attack, the galleries may cross and re-cross forming a complex network. The timing of western pine beetle attacks depends upon elevation, but in British Columbia they can occur any time from May to September.

Reddish-brown boring dust will be present on attacked trees. Reddish-brown pitch tubes that are 6.0 to 13.0 mm in diameter can be found in bark crevices midway up the tree. Needles will pale and then fade to yellow, sorrel, and finally to red in the months following an attack. Flaking of the bark by woodpeckers in search of beetles or larvae is also a sign of an infestation.

DAMAGE: Usually, western pine beetle breeds in scattered, over-mature, slow growing or diseased trees, and trees weakened by stand stagnation, lightning, fire, or mechanical injury. This beetle, however, will also attack and kill healthy young trees during an epidemic, although trees under 15.0 cm in diameter are seldom attacked. Attacking adults also carry the spores of a blue-staining fungus, *Ceratocystis minor*, which can invade and block, along with feeding larvae, the conductive vessels of the inner bark and sapwood.

REFERENCES: Chamberlin, W.J. 1958. The Scolytoidea of the northwest. Oregon State College. Studies in Entomology, Number 2. 208p.

DeMars, C.J. and B.H. Roettgering. 1982. Western pine beetle. 1966. U.S.D.A. Forest Service. Forest Insect and Disease Leaflet 1. 8 (4).

Furniss, R.L. and V.M. Carolin. 1980. Western forest insects. 1977. U.S.D.A. Forest Service. Misc. Pub. 1339. 654p.

WESTERN BALSAM BARK BEETLE *Dryocoetes confusus*

DISTRIBUTION: Follows the range of its primary host. In British Columbia, sub-alpine forests cover large areas of the interior.

TREE SPECIES ATTACKED: Primarily sub-alpine fir, but occasionally amabilis fir. Some attacks of white spruce and Engelmann spruce have been recorded.

INSECT DESCRIPTION AND DAMAGE SYMPTOMS: Adults are 3.4 to 4.3 mm long, dark brown, and covered with erect red-brown hairs. They emerge in late May or June. The life cycle normally requires two years, but, given the right climatic conditions, it could be completed in one year.

The extent of an infestation is difficult to determine as a result of overlapping life cycles, a lack of telltale pitch tubes, and the fact that the majority of the attacks occur above 2.0 m on the bole. The adults construct egg galleries which have a central nuptial chamber with brood galleries radiating from the top and bottom. A mixture of boring dust and frass is usually found in bark fissures and at the base of the bole. The foliage of an attacked tree will change from green to a bright, brick red color in the year following the attack, but the red needles may be retained for up to five years.

DAMAGE: Given the appropriate conditions, balsam bark beetles can be responsible for an extensive amount of tree mortality in stands containing a large percentage of the preferred host. Normally, however, less than 5% of a stand is attacked in a single season. The adult carries a lesion-causing fungus, *Ceratocystis dryocoetidis*, which is responsible for an estimated 65% of the mortality associated with balsam bark beetles. The lesions caused by the fungus may girdle and kill a tree, and they also make the tree susceptible to further beetle attacks.

REFERENCES: Furniss, R.L. and V.M. Carolin. 1980. Western forest insects. 1977. U.S.D.A. Forest Service. Misc. Pub. 1339. 654p.

Garbutt, R. 1992. Western balsam bark beetle. Canadian Forestry Service, Pacific Forestry Centre. Forest Pest Leaflet 64. 4p.

Holsten, E.H., R.A. Werner, and T.H. Laurent. 1980. Insects and diseases of Alaskan forests. U.S.D.A. Forest Service. Alaska Region Report Number 75. 187p.

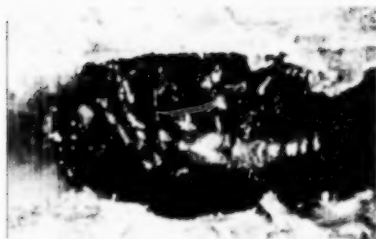


Figure 1. MOUNTAIN PINE BEETLE adult in a gallery.

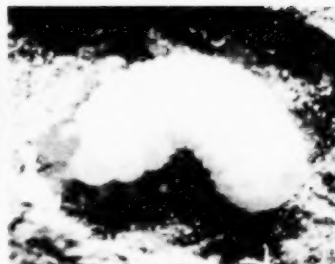


Figure 2. MOUNTAIN PINE BEETLE larva.



Figure 3. MOUNTAIN PINE BEETLE egg and larval galleries. Note: galleries tend to follow the grain of the wood.



Figure 4. MOUNTAIN PINE BEETLE pitch tubes usually appear from the duff line to a top diameter of 15 cm.



Figure 5. MOUNTAIN PINE BEETLE attacked trees. Note: red color is usually visible within a year following attack.



Figure 6. SPRUCE BEETLE adult.



Figure 7. SPRUCE BEETLE larvae. Note: anal shields.



Figure 8. SPRUCE BEETLE egg and larval galleries are up to 13 cm long. Frass is usually present in the galleries.



Figure 9. SPRUCE BEETLE killed trees.



Figure 10. Woodpecker bark scaling of a SPRUCE BEETLE attacked tree.

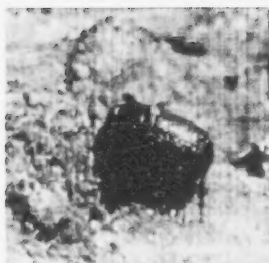


Figure 11. DOUGLAS-FIR BEETLE adult.

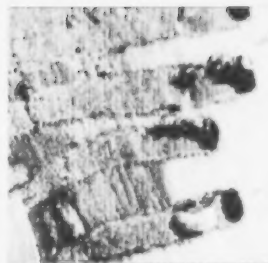


Figure 12. DOUGLAS-FIR BEETLE larva in gallery.



Figure 13. DOUGLAS-FIR BEETLE egg and larval galleries are about 30 cm in length and packed with frass.

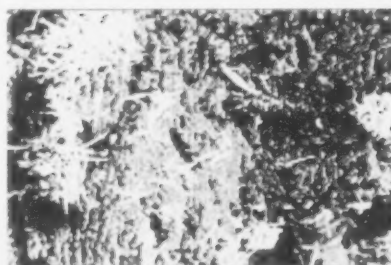


Figure 14. DOUGLAS-FIR BEETLE boring dust can be found in crevices at the base of the tree.



Figure 15. DOUGLAS-FIR BEETLE attacked trees. Note: red color usually appears by the spring of the year following an attack.

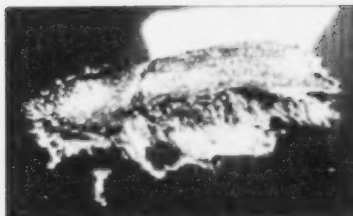


Figure 16. IPS BEETLE adult.
Note: rear concave depression
lined with spines.



Figure 18. IPS BEETLE
egg and larval galleries.
Larval galleries radiate
from the central nuptial
chamber. No frass is
present.



Figure 17. IPS BEETLE larvae brood in
a lodgepole pine tree. IPS galleries tend
to contain multiple generations.



Figure 19. Woodpecker
bark scaling of an IPS
BEETLE attacked tree.



Figure 20. LODGEPOLE PINE BEETLE larvae. Note: anal shields.



Figure 21. LODGEPOLE PINE BEETLE egg and larval galleries. Note: larval galleries may run together and become indistinct.



Figure 22. LODGEPOLE PINE BEETLE pitch tubes on the lower bole of an attacked tree.



Figure 23. WESTERN PINE BEETLE adult on pitch tube. Note: these are usually found midway on the tree bole.

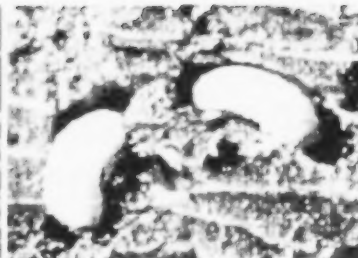


Figure 24. WESTERN PINE BEETLE larvae.



Figure 25. WESTERN PINE BEETLE egg and larval galleries. These are usually dust packed. Eggs are laid in niches cut into the gallery sides.



Figure 26. WESTERN PINE BEETLE killed ponderosa pine.

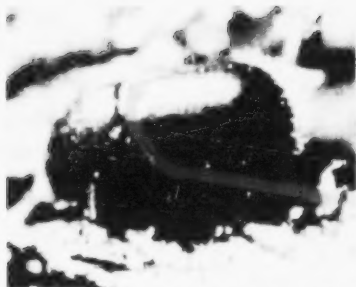


Figure 27. WESTERN BALSAM BEETLE adult.

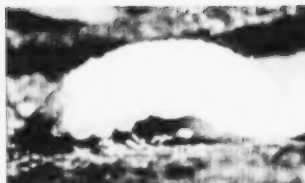


Figure 28. WESTERN BALSAM BEETLE larva.



Figure 29. WESTERN BALSAM BEETLE egg and larval galleries. Eggs are laid in niches cut into gallery sides.

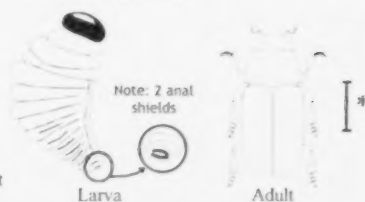


Figure 30. WESTERN BALSAM BEETLE attacked trees. Note: this color usually appears within a year following an attack.

Lodgepole Pine Beetle (*Dendroctonus murrayanae*)



Galleries: run together and become indistinct

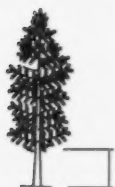


Larva

Adult

Signs and Symptoms: Large pitch tubes on the lower bole and root crown.

Attributes: Attacks stressed lodgepole pine. Not an aggressive tree killer like mountain pine beetle. Larvae can be found near and under the duff line, and they can be distinguished from mountain pine beetle larvae by the presence of two anal shields. Adults are dark brown to black with reddish wing covers and are about 5.5 to 6.5 mm long.



Distribution of Pitch Tubes

Hylurgops rugipennis



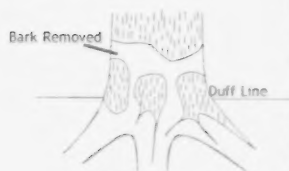
Gallery Pattern



Adult

Signs and Symptoms: Bark removal at and below the root collar.

Attributes: Attacks concentrated at and below root collar on pine, spruces, Douglas-fir, and western hemlock. Attacks dead or dying trees only. Adult is reddish-brown. Larvae will mine large lateral roots and the taproot in mineral soil. Larvae feed together and so individual larval galleries are indistinct and generally travel downwards.

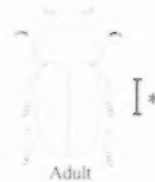


Distribution of Pitch Tubes and Galleries

Western Pine Beetle (*Dendroctonus brevicomis*)



Gallery: dust packed, eggs laid in niches cut into sides



Adult

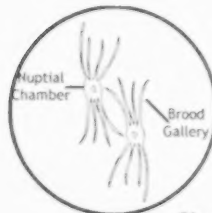
Signs and Symptoms: Inconspicuous pitch tubes and red boring dust. Woodpecker damage. Foliage fades to yellow, sorrel, then red within a year following the attack.

Attributes: Usually attack over-mature ponderosa pine, windfalls, root-diseased trees, or stressed trees. One to two generations annually depending on range. Flight and attack begin in late spring or early summer and continue until stopped by cold weather. Adults are brown to black and about 3.0 to 5.0 mm long. Adults carry spores of a blue-stain fungus which contributes to the death of attacked trees.



Distribution of Pitch Tubes

Western Balsam Bark Beetle (*Dryocoetes confusus*)



Gallery: eggs laid in niches cut into sides



Adult

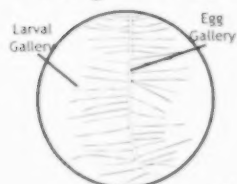
Signs and Symptoms: Detection and population assessment difficult due to lack of pitch tubes. A mixture of boring dust and frass may be evident. Foliage fades to red in the year following an attack.

Attributes: Tend to attack dying, dead, and downed alpine fir, but will attack and kill healthy trees. One- to two-year life cycle with adults emerging in late May or June. Adults are dark brown and about 3.4 to 4.3 mm long.



Distribution of Pitch Tubes

Douglas-fir Beetle (*Dendroctonus pseudotsugae*)



Gallery: frass present, average about 30 cm in length



Adult

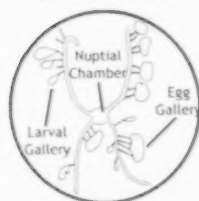
Signs and Symptoms: Reddish-brown boring dust. No pitch tubes but resin may exude from upper attacks. Foliage fades to yellow-green then red by the spring of the year following the attack.

Attributes: Normally attack felled, injured, or diseased Douglas-fir, but will kill large areas of healthy timber during epidemics. Usually has a one-year life cycle. Overwintering adults emerge from April to July. Overwintering larvae mature and emerge as adults in July and August. Adults are dark brown to black with reddish wing covers and are 4.4 to 7.0 mm long. Adults carry spores of a blue-stain fungus which contributes to the death of attacked trees.

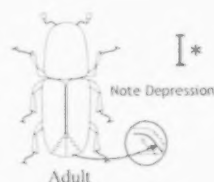


Distribution of Pitch Tubes

Ips Beetle (*Ips* spp.)



Gallery: multi-armed, radiating; multiple generations, no frass present



Adult

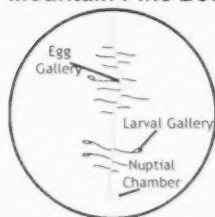
Signs and Symptoms: Dead tops on lodgepole pine, especially on margins of cut blocks. Very small or no pitch tubes. Fine boring dust. Foliage fades to pale green shortly after the initial attack.

Attributes: Usually attack dead, dying or damaged pine or spruce. Often attacks upper portions and south sides of mountain pine beetle killed pine. Heavy populations can build up in windthrow and slash which will then kill adjacent green trees. Ips damage often occurs at margins of cut blocks or road edges. Adults are reddish-brown to black and about 3.0 to 6.5 mm long.



Distribution of Pitch Tubes

Mountain Pine Beetle (*Dendroctonus ponderosae*)



Gallery : frass present, long and vertical, up to 30 cm long



Adult

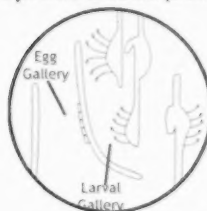
Signs and Symptoms: Pitch tubes usually appear from the duff line to a top diameter of 15.0 cm. White or reddish-brown boring dust. Foliage fades to yellow then to red within a year following the initial attack.

Attributes: Adults attack mature or over-mature lodgepole pine from July to early September. Usually have a one-year life cycle. Adults are 3.5 to 6.5 mm long and are mostly black to brownish-black. Adults carry spores of a blue-stain fungus which contributes to the death of attacked trees.

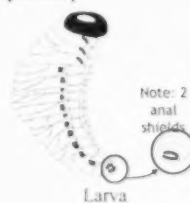


Distribution of Pitch Tubes

Spruce Beetle (*Dendroctonus rufipennis*)



Gallery: frass present, up to 13 cm long



Larva



Adult

Signs and Symptoms: Light-brown boring dust. White or reddish-brown pitch tubes are rarely present. Woodpecker damage. Foliage usually fades to yellowish-green during the winter following the attack.

Attributes: Adults attack slash, windfall, stumps and live Engelmann, white, or Sitka spruce from late May to early July. Usually have a two-year life cycle. Larvae can be distinguished by presence of two anal shields. Adults are black/brown or black with reddish wing covers and are 4.0 to 7.0 mm long. Adults carry spores of a blue-stain fungus which contributes to the death of attacked trees.



Distribution of Pitch Tubes

